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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/530,756

11/10/2005

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EXAMINER

HUNG, MING HUNG

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/530,756	<b>Applicant(s)</b> KOBAYASHI ET AL.	
	<b>Examiner</b> MING HUNG HUNG	<b>Art Unit</b> 4158	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 10 November 2005.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-11 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-11 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11/10/05 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>11/10/05</u> .  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Priority***

Examiner acknowledged that this application 10/530,756 filed on 11/10/05 claims the benefit of the foreign application JP 2002-297607 filed on 10/10/02. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

### ***Specification***

1. The disclosure is objected to because of the following informalities:
  - a. Page 1, line 15, "CCD reading part" should read "charge-coupled device (CCD) reading part".
  - b. Page 1, line 26, "S/N" should read "signal-to-noise ratio (S/N)".
  - c. Page 2, lines 16-17, "a cooling member 103" and "package 107" should read "a cooling member 107" and "package 103", respectively.
  - d. Page 25, the Abstract should not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited.

Appropriate correction is required.

### ***Drawings***

2. Figure 1 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in

compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

***Claim Rejections - 35 USC § 102***

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1, 4, 5, 7 and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Takumi (JP 05-047972 cited by the Applicant; the rejection is based on the machine English-translation of JP 05-047972, which is attached with this Office Action).

5. As to claim 1, Takumi discloses a packaging structure of semiconductor device comprising:

a photodetection device comprising ([0002], line 2, Drawing 2):

a semiconductor substrate (substrate 1, Drawing 2) having a back surface which serves as a light-incident surface ([0002], lines 5-8; 2<sup>nd</sup> principle surface 3, Drawing 2)

Art Unit: 4158

and a front surface which opposes said back surface ([0002], lines 5-8; 1<sup>st</sup> principal surface 2, Drawing 2) and is provided with a charge reading part constituted by a charge-coupled device that detects light propagating from the back surface ([0002], lines 8-9; [0004], lines 1-10; [0010], lines 3-5; active components 21 as in Drawings 1 or 4), the semiconductor substrate having a structure such that the thickness of a region at which the charge reading part is disposed (the distance between active component 21 and 2<sup>nd</sup> principle surface 3 as shown in Drawing 4) is thinner than the thickness of the remaining region (the distance between 1<sup>st</sup> principal surface 2 and 2<sup>nd</sup> principle surface 3 as shown in Drawing 4);

a cooling device cooling the charge reading part ([0002], lines 13-14; buffer material 8 as shown in Drawings 1-4), the cooling device having a cooling surface which has a size that is larger than the region at which the charge reading part is disposed (principle surface 19 and active components 21, respectively, Drawing 4a) and yet smaller than the entirety of the front surface of the semiconductor substrate (1<sup>st</sup> principal surface 2, Drawing 4a), and which contacts the front surface of said semiconductor substrate while covering the entirety of the charge reading part (Drawing 4b);

a package having a cavity which houses both the semiconductor substrate and the cooling device (4, external lead 6, glass tube 9, metallic wiring 10, 11 and 13 together form the package, Drawing 2), and being provided with package terminals electrically communicating between the cavity and the exterior thereof (internal metal lead 5 and electrode 12; Drawing 2);

electrode pads provided on the front surface of the semiconductor substrate and positioned at the peripheral of the region covered by the cooling surface (it is inherent that the 1<sup>st</sup> principal surface 2 has electrodes, such as metals or conductive layers, in order for the substrate 1 and the active components 21 to transmit electrical signal to the package formed by 4, external lead 6, glass tube 9, metallic wiring 10, 11 and 13 via 7, Drawing 2); and

bonding wires electrically connecting the package terminals and the electrode pads (7, Drawings 1-4).

6. As to claims 4 and 5, Takumi discloses a packaging structure of semiconductor device comprising:

where the package has a top plate for closing an upper opening of the cavity (window 14, Drawing 2) [claim 4];

where the semiconductor substrate, housed in the cavity, is supported on the package via the cooling device (Drawing 2) while being separated by a predetermined distance from the inner wall of the cavity (the distance between substrate 1 and internal metal lead 5, Drawing 2) [claim 5];

7. As to claim 7, Takumi discloses a packaging structure of semiconductor device comprising:

a photodetection device manufacturing method (Drawing 2) comprising the steps of:

preparing a semiconductor substrate (substrate 1, Drawing 2) having a back surface which serves as a light-incident surface ([0002], lines 5-8; 2<sup>nd</sup> principle surface 3, Drawing 2), and a front surface which opposes the back surface ([0002], lines 5-8; 1<sup>st</sup> principle surface 2, Drawing 2) and is provided with a charge reading part constituted by a charge-coupled device that detects light propagating from the back surface ([0002], lines 8-9; [0004], lines 1-10; [0010], lines 3-5; active components 21, Drawings 1 or 4), the semiconductor substrate having a structure such that the thickness of a region at which the charge reading part is disposed (the distance between active component 21 and 2<sup>nd</sup> principle surface 3, Drawing 4) is thinner than the thickness of the remaining region (the distance between 1<sup>st</sup> principal surface 2 and 2<sup>nd</sup> principle surface 3; Drawing 4);

preparing a cooling device ([0002], lines 13-14; buffer material 8; Drawings 1-4) having a cooling surface with a size (principle surface 19, Drawing 4a) smaller than the entirety of the front surface of the semiconductor substrate (1<sup>st</sup> principal surface 2, Drawing 4a) and yet larger than the region at which the charge reading part is disposed (active components 21, Drawing 4a);

preparing a package having a cavity which houses both the semiconductor substrate and the cooling device (4, external lead 6, glass tube, metallic wiring 10, 11 and 13 together form the package, Drawing 2);

disposing the cooling device inside the cavity of the package (Drawing 2) such that a back surface of the cooling device (the bottom surface of buffer material 8 that touches glass tube 9, Drawing 2), at the side opposite the cooling surface (the top

Art Unit: 4158

surface of buffer material 8 that touches substrate 1, Drawing 2), faces a cavity bottom part of the package (the area where the glass tube 9 is touched by buffer material 8, Drawing 2);

disposing the semiconductor substrate in the cavity of the package (Drawing 2) such that the cooling surface contacts the charge reading part in a covering manner (Drawing 4b) and yet the semiconductor substrate is separated from the inner wall of the cavity of the package by a predetermined distance (the distance between substrate 1 and internal metal lead 5, Drawing 4a); and

connecting electrode pads, which are disposed on the front surface of the semiconductor substrate and positioned at the peripheral to the region covered by the cooling surface (it is inherent that the 1<sup>st</sup> principle surface 2 has electrodes in order for the substrate 1 and the active components 21 to communicate with the package formed by 4, external lead 6, glass tube 9, metallic wiring 10, 11 and 13, Drawing 2), to package terminals provided on the package (internal metal lead 5, Drawing 2), by bonding wires (7, Drawing 2).

8. As to claim 11, Takumi discloses a packaging structure of semiconductor device comprising:

where, after making the connections by the bonding wires, an upper opening of the cavity of the package is closed by a top plate (window 14 is the top plate, and 7 is formed first before window 14 is placed, see Drawings 1 and 2).



***Claim Rejections - 35 USC § 103***

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 2 and 3 are 35 U.S.C. 103(a) as being unpatentable over Takumi in view of Yoshida et al. (US Patent No. 4,039,114 and Yoshida hereinafter).

Takumi discloses substantial features of the claimed invention (see paragraphs above), and further discloses:

where the cooling device (buffer material 8, Drawings 1-4) is fixed to the package (the package formed by 4, external lead 6, glass tube, metallic wiring 10, 11 and 13) while the surface at the opposite side of the cooling surface contacts a bottom part of the cavity of the package (the area where the glass tube is touched by buffer material 8, Drawing 2) [claim 2].

However, Takumi fails to disclose:

where a working opening is provided at the cavity bottom part of the package that correspond to the electrode pads and the package terminals [claim 2];

further comprising a cover for closing the working opening provided at the cavity bottom part of the package [claim 3].

Nonetheless, Yoshida discloses a wire-bonding equipment comprising:

wire-bonding equipment has jigs which may be secured on a mounting support whereat an electronic or other module may be loaded onto a jig and moved into a correct alignment observable on a television screen, and the jigs are transportable from the mounting support location to a positioning table location whereat successive jigs are automatically moved in a requisite manner to bring successive terminal of modules loaded thereon to a position for bonding of wires thereto by a simultaneously actuated wire-bonder unit (Abstract, lines 1-10).

Therefore, it would have been obvious to one of ordinary skills in the art at the time of the invention was made to include the claimed features for the purpose of wire bonding, since it has been held that constructing a formerly integral structure in various elements (cavity bottom part 2a and covers 9, Fig 6B of the present application) involves only routine skill in the art. *Nerwin v. Erlichman*, 168 USPQ 177, 179.

11. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takumi in view of Miyaguchi et al. (US Patent No. 5,508,740 and Miyaguchi hereinafter).

Takumi discloses substantial features of the claimed invention (see paragraphs above), and further discloses:

where the cooling device (buffer material 8, Drawings 1-4) includes a cooling plate (adhesive 20, Drawing 1a or 4a; it is inherent that adhesive 8 is thermal conductive, otherwise the use of buffer material 8 is useless) contacting the cooling side of the cooling device (principle surface 19, Drawings 1a or 4a), and where a back surface of the cooling plate, which is opposite the surface that contact the cooling side

of the cooling device (the top surface of adhesive 20, Drawings 1a or 4a), contact the front surface of the semiconductor substrate as the cooling surface (1<sup>st</sup> principle surface 2, Drawing 4).

However, Takumi fails to disclose:

where the cooling device includes a Peltier element.

Nonetheless, this feature is well known and would have been an obvious modification of the device disclosed by Takumi, as evidenced by Miyaguchi.

Miyaguchi discloses solid-state imaging device having temperature sensor comprising:

where the cooling device includes a Peltier element (col. 1, lines 44-49; col. 4, lines 15-16; Peltier element 220, Fig. 1)

Given the teaching of Miyaguchi, a person having ordinary skills in the art at the time of the invention would have readily recognized the desirability and advantages of modifying Takumi by employing the well known or conventional features of Peltier element, such as disclosed by Miyaguchi, in order to provide solid state cooling without liquid that is compact and high conductance.

12. Claims 8-10 rejected under 35 U.S.C. 103(a) as being unpatentable over Takumi in view of Yoshida.

13. As to claim 8, although Takumi discloses substantial features of the claimed invention (see paragraphs above), it fails to disclose:

where the connections made by the bonding wires are made in a state in which said semiconductor substrate is support by a jig that has been inserted from an upper opening of the cavity of the package.

Nonetheless, these features are well know and would have been an obvious modification of the device disclosed by Takumi, as evidenced by Yoshida.

Yoshida discloses a wire-bonding equipment comprising:

wire-bonding equipment has jigs which may be secured on a mounting support whereat an electronic or other module may be loaded onto a jig and moved into a correct alignment observable on a television screen, and the jigs are transportable from the mounting support location to a positioning table location whereat successive jigs are automatically moved in a requisite manner to bring successive terminal of modules loaded thereon to a position for bonding of wires thereto by a simultaneously actuated wire-bonder unit (Abstract, lines 1-10).

Given the teaching of Yoshida, a person having ordinary skills in the art at the time of invention would have readily recognized the desirability and advantages of modifying Takumi by employing the well known or conventional features of wire-bonding, in order to automatically bond the wires with improved efficiency in module production and packaging.

14. As to claims 9 and 10, although Takumi discloses substantial features of the claimed invention (see paragraphs above), it fails to disclose:

where, at a bottom part of the cavity of the package, a working opening is provided at a position corresponding to the electrode pads and the package terminals, and where the connections made by the bonding wires are made through the working opening [claim 9];

where, after making the connections by the bonding wires, the working opening is closed by a cover [claim 10].

Nonetheless, Yoshida discloses a wire-bonding equipment comprising:

wire-bonding equipment has jigs which may be secured on a mounting support whereat an electronic or other module may be loaded onto a jig and moved into a correct alignment observable on a television screen, and the jigs are transportable from the mounting support location to a positioning table location whereat successive jigs are automatically moved in a requisite manner to bring successive terminal of modules loaded thereon to a position for bonding of wires thereto by a simultaneously actuated wire-bonder unit (Abstract, lines 1-10).

Therefore, it would have been obvious to one of ordinary skills in the art at the time of the invention was made to include the claimed features for the purpose of wire bonding, since it has been held that constructing a formerly integral structure in various elements (cavity bottom part 2a and covers 9, Fig 6B of the present application) involves only routine skill in the art. *Nerwin v. Erlichman*, 168 USPQ 177, 179.

***Contact Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ming Hung Hung whose telephone number is (571)270-3832. The examiner can normally be reached on Monday through Friday 7:30AM-5:00PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Walter Benson can be reached on (571)272-2227. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ming Hung Hung/  
Examiner, Art Unit 4158

/Walter Benson/  
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